Movement of Rambutan fruit, *Nephelium lappaceum*, from Hawaii into other regions of the United States

Qualitative, Pathway-Initiated Pest Risk Assessment

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A. Introduction

This pest risk assessment was prepared by the Animal and Plant Health Inspection Service (APHIS) of the U.S. Department of Agriculture (USDA) to examine plant pest risks associated with the movement into the United States of **fresh rambutan fruits (*Nephelium lappaceum* L.) grown in Hawaii**. This is a qualitative pest risk assessment, that is, estimates of risk are expressed in qualitative terms such as high or low as opposed to numerical terms such as probabilities or frequencies.

International plant protection organizations (*e.g.*, North American Plant Protection Organization (NAPPO), International Plant Protection Convention (IPPC) of the United Nations Food and Agriculture Organization (FAO)) provide guidance for conducting pest risk analyses. The methods used to initiate, conduct, and report this plant pest risk assessment are consistent with guidelines provided by NAPPO, IPPC and FAO. The biological and phytosanitary terms (*e.g.*, introduction, quarantine pest) used in this document conforms with the *NAPPO Compendium of Phytosanitary Terms* (NAPPO 1995) and the *Definitions and Abbreviations* (Introduction Section) in *International Standards for Phytosanitary Measures, Section 1—Import Regulations: Guidelines for Pest Risk Analysis* (FAO 1995).

Pest risk assessment is one component of an overall pest risk analysis. The *Guidelines for Pest Risk Analysis* provided by FAO (1995) describe three stages in pest risk analysis. This document satisfies the requirements of FAO Stages 1 (initiation) and 2 (risk assessment).

The Food and Agriculture Organization (FAO, 1995) defines "pest risk assessment" as "Determination of whether a pest is a quarantine pest and evaluation of its introduction potential". "Quarantine pest" is defined as "A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled" (FAO, 1995; NAPPO, 1995). Thus, pest risk assessments should consider both the likelihood and consequences of introduction of quarantine pests. Both issues are addressed in this qualitative pest risk assessment.

This document presents the findings of the qualitative plant pest risk assessment. The assessment methods or the criteria used to rate the various risk elements are not described in detail. The details of the methodology and rating criteria can be found in the "template" document: ***Pathway-Initiated Pest Risk Assessment: Guidelines for Qualitative Assessments, version 4.0*** (USDA, 1995); to obtain a copy of the template, contact the individual named in the proposed regulations.

B. Risk Assessment

1. Initiating Event: Proposed Action

This pest risk assessment is commodity-based, and therefore "pathway-initiated"; the assessment is in response to a request for USDA authorization to allow movement of a particular commodity presenting a potential plant pest risk. In this case, the movement of **fresh rambutan fruits (*Nephelium lappaceum* L.) grown in Hawaii** into other parts of the U.S. is a potential pathway for introduction of plant pests. Regulatory authority for the movement of fruits and vegetables from Hawaii into other parts of the U. S. is found in 7 CFR §318.13.

Nephelium belongs to the family Sapindaceae which includes about 140 genera and 2000 species of

trees, shrubs, and a few herbs distributed widely in tropical and warm regions. It is native to Malaysia and Indonesia (Laksmi *et. al.* 1987) Some of the species are ornamental and some yield edible fruits (Neal, 1965). *Nephelium lappaceum* is a small tree, cultivated for its fruit (Uphof, 1968). *Nephelium* is grown in Florida and Puerto Rico.

2. Assessment of Weediness Potential of Rambutan, *Nephelium lappaceum*

Table 1 shows the results of the weediness screening for *Nephelium lappaceum.* These findings did not require a pest-initiated risk assessment.

Table 1: Process for Determining Weediness Potential of Commodity

Commodity: *Nephelium lappaceum* (L.) - (Rambutan)

Phase 1: Rambutan is in limited production in Florida and Puerto Rico

Phase 2: Is the species listed in:

NO	*Geographical Atlas of World Weeds* (Holm, 1979)
NO	*World's Worst Weeds* (Holm, 1977)
NO	*Report of the Technical Committee to Evaluate Noxious Weeds; Exotic Weeds for Federal Noxious Weed Act* (Gunn & Ritchie, 1982)
NO	*Economically Important Foreign Weeds* (Reed, 1977)
NO	Weed Science Society of America list (WSSA, 1989)
NO	Is there any literature reference indicating weediness (*e.g.*, *AGRICOLA*, *CAB*, *Biological Abstracts*, *AGRIS*; search on "species name" combined with "weed").

Phase 3: Conclusion:

This commodity does not pose a significant risk as a weed.

3. Previous Risk Assessments, Current Status and Pest Interceptions

3a. Decision history for *Nephelium* spp.

There are no previous risk assessments (decision sheets) on *Nephelium* spp. from Hawaii.

3b. Interceptions from Hawaii FY 1985-95

No interceptions on this host from Hawaii.

4. Pest List: Pests Associated with Rambut an in Hawaii

Table 2 shows the pest list for *Nephelium* spp. which was developed after review of the information sources listed in USDA (1995). The pest list summarizes information on the distribution of each pest, pest-commodity association, and regulatory history.

Table 2: Pest List - *Nephelium* spp.

Scientific Name, Classification	Distribution[1]	Comments[2]	References
Pathogens			
Cercospora sp. (Fungi Imperfecti: Hyphomycetes)	HI,US	a	Kunishi & Kitagawa, 1996; Farr *et. al.*, 1989
Cladosporium sp. (Fungi Imperfecti: Hyphomycetes)	HI,US	z_e postharvest rot	Kunishi & Kitagawa, 1996; Farr *et. al.*, 1989
Colletotrichum sp. (Fungi Imperfecti: Coelomycetes)	HI,US	z_e postharvest rot	Kunishi & Kitagawa, 1996; Farr *et. al.*, 1989
Coniothyrium sp. (Fungi Imperfecti: Coelomycetes)	HI,US	a	Kunishi & Kitagawa, 1996; Farr *et. al.*, 1989
Fusarium sp. (Fungi Imperfecti: Hyphomycetes)	HI,US	a	Kunishi & Kitagawa, 1996; Farr *et. al.*, 1989
Gliocephalotrichum bulbilium J. J. Ellis & Hesseltine (Fungi Imperfecti: Hyphomycetes)	HI	m,z_e	Farr *et. al.*, 1989; Visarathanonth & Ilag, 1987
Gloeosporium sp. (Fungi Imperfecti: Coelomycetes)	HI,US	a	Kunishi & Kitagawa, 1996; Farr *et. al.*, 1989

Glomerella cingulata (Stoneman) Spauld. & H. Schrenk (Pyrenomycetes: Phyllachorales) Anamorph *Colletotrichum gloeosporioides* (Penz.) Penz. & Sacc. in Penz.	HI,US	c,m,o,z_e	Farungsang *et. al.*, 1994; Raabe *et. al.*, 1981; Farr *et. al.*, 1989
Lasiodiplodia theobromae (Pat.) Griffon & Maubl. (Fungi Imperfecti: Coelomycetes)	HI,US	c,m,o,z_e	Visarathanonth & Ilag, 1987; Farr *et. al.* 1989
Pestalotia sp. (Fungi Imperfecti: Coelomycetes)	HI,US	c,z_e	Kunishi & Kitagawa, 1996; Farr *et. al.*, 1989
Phoma sp. (Fungi Imperfecti: Coelomycetes)	HI,US	a	Kunishi & Kitagawa, 1996; Farr *et. al.*, 1989
Phomopsis sp. (Fungi Imperfecti: Coelomycetes)	HI,US	a	Kunishi & Kitagawa, 1996; Farr *et. al.*, 1989
Phyllosticta sp. (Fungi Imperfecti: Coelomycetes)	HI,US	a	Kunishi & Kitagawa, 1996; Farr *et. al.*, 1989
Phytophthora nicotianae Breda de Haan var. *parasitica* (Dastur) G.M. Waterhouse (Oomycetes: Peronosporales)	HI,US	c,m,o,z_e	Raabe *et. al.*, 1981; Tindall, 1994
Rhizopus stolonifer (Ehrenb.:Fr.) Vuill. (Zygomycetes: Mucorales)	HI,US	c,o,z_e	Raabe *et. al.*, 1989
Arthropods			
Abgrallaspis cyanophylli (Signoret) (Homoptera: Diaspididae)	HI,US	c,o,z_e	Nakahara, 1982; Kunishi & Kitagawa, 1996
Amorbia emigratella Busck (Lepidoptera: Tortricidae)	HI,US	c,o,z_e	Kunishi & Kitagawa, 1996; USDA, 1996
Aulacaspis alisiana Takagi (Homoptera: Diaspididae)	HI	a	Anon., 1994
Bactrocera dorsalis Hendel (Diptera: Tephritidae	HI,US_3	h,n,z_i	Oakley, 1950; Tindall, 1994; Anon, 1994

Ceratitis capitata (Wiedemann) (Diptera: Tephritidae)	HI,US_3	h,n,z_i	BASS, 1985
Ceroplastes rubens Maskell (Homoptera: Coccidae)	HI,GU,FL	a,n,z_e(?)	Hamon & Williams, 1984; Kunishi & Kitagawa, 1996; USDA, 1996
Coccus viridis (Green) (Homoptera: Coccidae)	HI,FL,(DC, NY in greenhouses)	h,n,z_e	Hamon & Williams, 1984; Kunishi & Kitagawa, 1996; USDA, 1996
Dysmicoccus brevipes (Cockerell) (Homoptera: Pseudococcidae)	HI,FL	c,f,o,y,z_e	Kunishi & Kitagawa, 1996
Dysmicoccus neobrevipes (Cockerell) (Homoptera: Pseudococcidae)	HI,FL	g,m,x,y,z_e	Anon. 1994; Harris & Maramorosch, 1980; Blackburn, 1988; USDA, 1996
Eudocima fullonia Cl. (Lepidoptera: Noctuidae)	HI	e,n	Anon., 1994; Tindall, 1994; CIE, 1977
Frankliniella schultzei (Trybom) (Thysanoptera: Thripidae)	HI	a,m,n,x,y	Cho *et. al.,* 1988; USDA, 1996; Harris & Maramorosch, 1980
Hemiberlesia lataniae (Signoret) (Homoptera: Diaspididae)	HI,US,PR	c,o,z_e	Nakahara, 1982; Kunishi & Kitagawa, 1996; Medina-Gaud *et. al.,* 1987
Hemiberlesia rapax (Comstock) (Homoptera: Diaspididae)	HI,US	c,o,z_e	Nakahara, 1982; Kunishi & Kitagawa, 1996; USDA, 1996
Howardia biclavis (Comstock) (Homoptera: Diaspididae)	HI,FL,(DC, KS,MD,NY,OH,PA,MO in greenhouses)	c,o,z_e	Hawaii, 1996
Maconellicoccus hirsutus (Green) (Homoptera: Pseudococcidae)	HI	m,n,z_e	USDA, 1996
Nipaecoccus nipae (Maskell) (Homoptera: Pseudococcidae)	HI,CA,FL	c,o,z_e	Kunishi & Kitagawa, 1996; CIE, 1966; USDA, 1996

Planococcus citri Risso (Homoptera: Pseudococcidae)	HI,US	c,o,y,z_e	Anon, 1994; Tindall, 1994; Kunishi & Kitagawa, 1996
Pseudococcus affinis (Maskell) (Homoptera: Pseudococcidae)	HI,US	c,o,z_e	Kunishi & Kitagawa, 1996; USDA, 1996
Pseudococcus longispinus (Targioni & Tozzetti) (Homoptera: Pseudococcidae)	HI,US	c,o,z_e	CIE, 1984; Kunishi & Kitagawa, 1996; USDA, 1996
Pulvinaria psidii (Maskell) (Homoptera: Coccidae)	HI,US,PR	c,o,z_e	Kunishi & Kitagawa, 1996; CIE, 1994; Medina-Gaud, 1987
Tetranychus cinnabarinus (Boisd.) (Acari: Tetranychidae)	HI,US	a,c,o	Anon., 1994; Tindall, 1994; CIE, 1978

[1] Distribution legend: HI = Hawaii; US = United States; CA = California; FL = Florida; DC = District of Columbia; NY = New York; GU = Guam

[2] Comments:
- a = Pest mainly associated with a plant part other than the commodity.
- c = Listed in non-reportable dictionary as non-actionable.
- e = Although pest attacks commodity, it would not be expected to remain with the commodity during processing.
- f = Pest occurs in the U.S. and is not subject to official restrictions and regulations.
- g = Quarantine pest, pest has limited distribution in the U.S. and is under official control as follows: pest listed by Name in USDA's pest dictionary, official quarantine action may be taken on this pest when intercepted on this commodity.
- h = Quarantine pest: has limited distribution in the U.S. and is under official control.
- m = The pest occurs within the PRA area and has been reported to attack the specified host species in other geographic regions; but has not been reported to attack the specified host species in the PRA area.
- n = Listed in the USDA catalogue of intercepted pests as actionable.
- o = Organism does not meet the geographical and regulatory definition for a quarantine pest.
- x = Multiple interception records exist on this host from other areas.
- y = Pest is a vector of plant pathogens.
- z_e = External pest: is known to attack or infest fruits of *Nephelium* spp. and it would be reasonable to expect the pest may remain with the commodity during processing and shipping.
- z_i = Internal pest: is known to attack or infest fruits of *Nephelium* spp. and it would be reasonable to expect the pest may remain with the commodity during processing and shipping.

3. *Bactrocera dorsalis* and *Ceratitis capitata* have been detected on occassion in the United States. Whenever they are detected, a quarantine is established and an eradication program implemented. These fruit flies are considered to be quarantine pests in the United States.

5. List of Quarantine Pests

The list of quarantine pests for commercial shipments of rambutan fruits from Hawaii is provided in Table 3. Should any of these pest be intercepted on commercial (or any other) shipments of rambutan, quarantine action will be taken.

Table 3: Quarantine Pests: Rambutan fruits consumption

Pathogens:	None
Arthropods:	*Bactrocera dorsalis* *Ceratitis capitata* *Ceroplastes rubens* *Coccus viridis* *Dysmicoccus neobrevipes* *Eudocima fullonia* *Frankliniella schultzei* *Maconellicoccus hirsutus*

Gliocephalotrichum bulbilium has not been associated with rambutan in Hawaii and has only been isolated in Hawaii from rotted wood of guava (*Psidium* sp., therefore it was not included in the list of quarantine pests.

6. Quarantine Pests Likely to Follow Pathway (*i.e.*, Quarantine Pests Selected for Further Analysis)

Only those quarantine pests that can reasonably be expected to follow the pathway, *i.e.,* be included in commercial shipments of rambutan fruits were analyzed in detail (see USDA, 1995 for selection criteria). Only quarantine pests listed in Table 4 were selected for further analysis and subjected to steps 7-9 below. *D. neobrevipes* and *M. hirsutus* have not been associated with rambutan in Hawaii, they have been intercepted on fruits from other tropical areas and therefore were included for further evaluation.

Table 4: Quarantine Pest Selected for Further Analysis: Hawaiian Rambutan Fruits for consumption

Arthropods	*Bactrocera dorsalis*
	Ceratitis capitata
	Ceroplastes rubens
	Coccus viridis
	Dysmicoccus neobrevipes
	Frankliniella schultzei
	Maconellicoccus hirsutus

7. Economic Importance: Consequences of Introduction

The consequences of introduction was considered for each pest selected for further analysis. For qualitative, pathway-initiated pest risk assessments, these risks were estimated by rating each pest with respect to five risk elements. A full description of these elements and rating criteria can be found in USDA (1995). Table 5 shows the risk ratings for these risk elements.

Table 5: Risk Rating: Consequences of Introduction

Pest	Climate/ Host	Host Range	Dispersal	Economic	Environ-mental	Risk Rating
Bactrocera dorsalis	high	high	high	high	high	high
Ceratitis capitata	high	high	high	high	high	high
Ceroplastes rubens	high	high	low	medium	medium	medium
Coccus viridis	high	high	low	medium	medium	medium
Dysmicoccus neobrevipes	low	high	low	medium	medium	medium
Franklinella schultzei	medium	high	medium	medium	medium	medium
Maconellicoccus hirsutus	medium	high	medium	high	high	high

8. Likelihood of Introduction

Each pest was rated with respect to introduction potential (*i.e.* entry and establishment). Two separate components were considered. First, the amount of commodity likely to be moved was estimated. More movement leads to greater risk; the result is a risk rating (0, 1, or 2) that applies to the commodity and country in question and is the same for all quarantine pest considered. Second, five biological features *i.e.,* risk elements, concerning the pest and its interactions with the commodity were considered. The resulting risk ratings were specific to each pest. Details of elements and rating criteria can be found in USDA (1995). The cumulative risk rating for introduction was considered to be an indicator of the likelihood that a particular pest would be introduced. Table 6 shows the rating for these risk elements.

Table 6: Risk Rating: Likelihood of Introduction

Pest	Quantity of commodity imported annually	Likelihood survive postharvest treatment	Likelihood survive shipment	Likelihood not detect at port of entry	Likelihood moved to suitable habitat	Likeli-hood find suit-able host	Risk rating
Bactrocera dorsalis	low	high	high	high	high	high	high
Ceratitis capitata	low	high	high	high	high	high	high
Ceroplastes rubens	low	high	high	medium	low	high	medium
Coccus viridis	low	high	high	medium	low	high	medium
Dysmicoccos neobrevipes	low	high	high	medium	medium	mediu m	medium
Franklinella schultzei	low	high	high	medium	medium	high	high
Maconellicoccus hirsutus	low	high	high	medium	low	low	medium

9. Conclusion: Pest Risk Potential and Phytosanitary Measures

The measure of pest risk potential combines the risk ratings for consequences and likelihood of introduction as described in USDA (1995). Table 7 shows the estimated pest risk potential for the quarantine pests selected for further analysis for the movement of *Nephelium lappaceum* fruits from Hawaii.

Table 7: Pest Risk Potential, Quarantine Pests, *Nephelium lappaceum* from Hawaii

Pest	Pest risk potential
Bactrocera dorsalis	high
Ceratitis capitata	high
Ceroplastes rubens	medium
Coccus viridis	medium
Dysmicoccus neobrevipes	medium
Franklinella schultzei	high
Maconellicoccus hirsutus	high

For those pests, except *Maconellicoccus hirsutus*, receiving a high PRP risk rating, we recommend specific phytosanitary measures, port-of-entry inspection is not considered sufficient to provide phytosanitary security. *M. hirsutus* has not been associated with *Nephelium* spp. in Hawaii and therefore movement of the fruit is unlikely to serve as a pathway for introduction. Although *M. hirsutus* is established in Hawaii it has had little or no impact, probably due to the introduction of a parasite about the same time. PPQ currently inspects other commodities which serve as hosts for this mealybug from the Caribbean area. If this mealybug is intercepted on Hawaiian rambutan fruits, Operational Support staff may establish appropriate sanitary and phytosanitary measures they believe necessary to mitigate pest risk. The pest risk management phase of the PRA is not part of this document. Appropriate sanitary and phytosanitary measures to mitigate pest risk will be determined during the pest risk management phase.

PPQ has over 1500 interception of pests on fruits of *Nephelium* spp. from other areas of the world; however, virtually all external pests listed could be detected by inspection. Some of these same pests occur in Hawaii in addition to other quarantine pests and have been intercepted as hitchhikers with other commodities. Should any of these pests be intercepted on commercial (or any other) shipments of rambutan, quarantine action may be taken.

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